calibration_part2

Jordan Sibley and Liz Peterson

Set Up

```r
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.1     v tibble    3.2.1
v lubridate 1.9.4     v tidyr     1.3.1
v purrr     1.0.2
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becom
```

```r
library(here)
```

```
here() starts at /Users/jordansibley/Desktop/MEDS/EDS_230/eds230-inclass
```

```r
source(here('R', 'compute_lowflowmetrics_all.R'))
```

Data

```r
# Load in data
msage = readRDS(here('week10', 'msage.RDS'))

# Rearrange so we can plot all results
#msagel = msage %>% gather(key="sim",value="str", -date, -month, -day, -year, -wy,-obs)
```

Directions

Using your performance metric that you developed in Calibration Part 1:

Use the performance values as weights to come up with a max likelihood estimate (MLE) of a) daily streamflow and b) another component of streamflow that is relevant given your performance metric (e.g August streamflow in the class example)

Graph MLE and observed for the streamflow component of interest

Compute the correlations between observed and the MLE and observed flow for daily flow and your streamflow component of interest

Compute performance metrics

```
# Rearrange so we can plot all results (long format)
msagel = msage %>%
  gather(key = "sim", value = "str", -date, -month, -day, -year, -wy, -obs)

# Compute performance metrics for each simulation
res <- msage %>%
  select(-date, -month, -day, -year, -wy, -obs) %>%
  apply(2, compute_lowflowmetrics_all,
        o = msage$obs,
        month = msage$month,
        year = msage$year,
        day = msage$day,
        wy = msage$wy)
```

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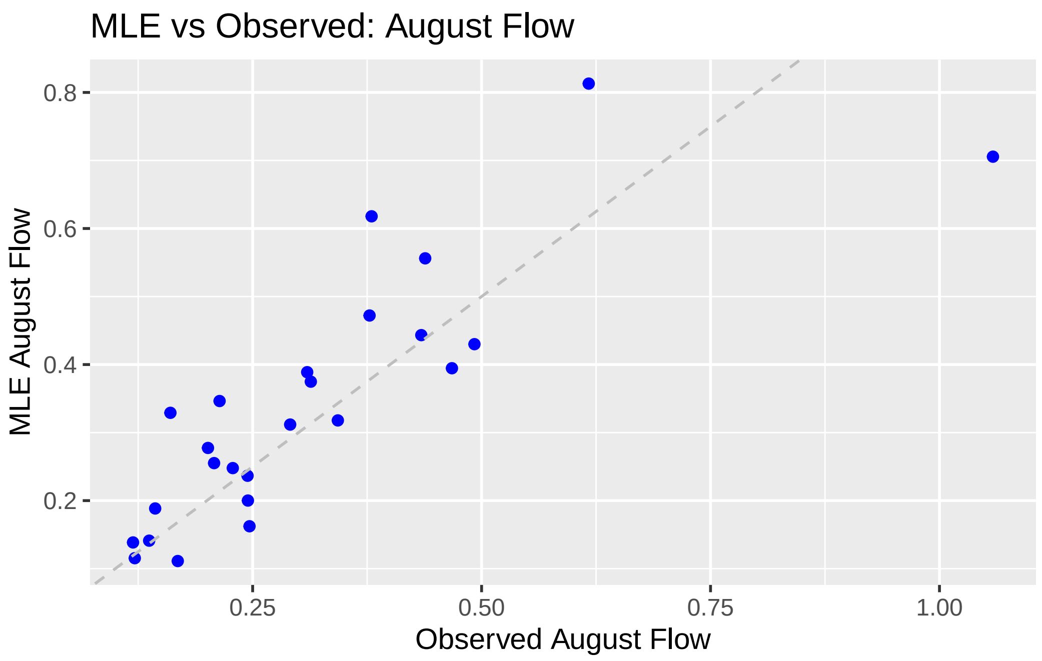
```r
# Convert results to dataframe
results <- as.data.frame(matrix(unlist(res), byrow = TRUE, ncol = 5))
colnames(results) <- c("annual_min_err", "annual_min_cor", "low_month_err", "low_month_cor",
results$sim <- colnames(msage %>% select(-date, -month, -day, -year, -wy, -obs))
```

Calculate MLE for August flow based on performance values as weights

```r
# Select top-performing parameter sets
topN <- 50
results_acc <- results %>%
  arrange(desc(combined)) %>%
  slice(1:topN)

# Normalize weights
results_acc <- results_acc %>%
  mutate(
    weight = (combined - min(combined)) / (max(combined) - min(combined)),
    weight = weight / sum(weight)
  )

# Join weights to long-form data
msagel_acc <- msagel %>%
  filter(sim %in% results_acc$sim) %>%
  left_join(results_acc %>% select(sim, weight), by = "sim")

# Calculate MLE of daily streamflow
mle_daily <- msagel_acc %>%
  group_by(date) %>%
  summarize(
    mle_flow = sum(str * weight, na.rm = TRUE),
    obs_flow = first(obs),
    .groups = "drop"
  )

# Add month and year
mle_daily <- mle_daily %>%
  mutate(month = month(date), year = year(date))

# August flow MLE and observed
aug_flow <- mle_daily %>%
  filter(month == 8) %>%
  group_by(year) %>%
  summarize(
    obs_aug = mean(obs_flow, na.rm = TRUE),
    mle_aug = mean(mle_flow, na.rm = TRUE),
    .groups = "drop"
  )
```

Plot results

```
# Plot MLE vs Observed August flow
ggplot(aug_flow, aes(x = obs_aug, y = mle_aug)) +
  geom_point(color = "blue") +
  geom_abline(slope = 1, intercept = 0, linetype = "dashed", color = "gray") +
  labs(x = "Observed August Flow", y = "MLE August Flow", title = "MLE vs Observed: August Fl
```



```r
# Correlations
cat("Correlation: Observed vs MLE Daily Flow\n")
```

```
Correlation: Observed vs MLE Daily Flow
```

```r
print(cor(mle_daily$obs_flow, mle_daily$mle_flow, use = "complete.obs"))
```

```
[1] 0.8152302
```

```r
cat("Correlation: Observed vs MLE August Flow\n")
```

```
Correlation: Observed vs MLE August Flow
```

```r
print(cor(aug_flow$obs_aug, aug_flow$mle_aug, use = "complete.obs"))
```

```
[1] 0.8263265
```